Conjoint Analysis of Nature Tourism Values in Bahia, Brazil

**Thomas Holmes, Chris Zinkhan,
Keith Alger and Evan Mercer**

FPEI Working Paper No. 57

The Forestry Private Enterprise Initiative (FPEI) is a cooperative project of the Southeastern Center for Forest Economics Research (SCFER) with the Forestry Support Program (FSP), the United States Agency for International Development (AID), Bureau for Science and Technology (S&T) [through its Office of Forestry, Environment, (and Natural Resources (FENR)], Organization for International Cooperation and Development (OICD), the United States Department of Agriculture (USDA) Forest Service-Southern Research Station (SRS), and North Carolina State University (NCSU).

Holmes, Thomas, Chris Zinkhan, Keith Alger and Evan Mercer. 1996. Southeastern Center for Forest Economics Research, Research Triangle Park, NC. FPEI Working Paper No. 57. 19 pp.

About the Authors

Thomas Holmes is Research Forester, USDA-Forest Service, Southern Research Station, Research Triangle Park, NC. Chris Zinkhan is Associate Professor, Daniel B. Warnell School of Forest Resources, The University of Georgia, Athens, GA. Keith Alger is Director, Institute for Socio-Environmental Studies, Ilhéus, Bahia, Brazil and Evan Mercer is Research Economist, USDA-Forest Service, Southern Research Station, Research Triangle Park, NC.

Acknowledgments

The authors would like to acknowledge Richard Rice and Karen Ziffer of Conservation International for their efforts in and funding of this research.

About FPEI Working Papers

FPEI working papers are a special series of SCFER working papers issued by the Southeastern Center for Forest Economics Research for the purpose of sharing the research findings of the Forestry Private Enterprise Initiative. These papers are distributed in order to promote the timely release of new theories, data, and findings. Working papers represent various levels of research findings and readers are encouraged to contact the author(s) for more information. Some of the papers may be published in modified form elsewhere. An updated list and copies of FPEI working papers are available from the Center at P.O. Box 12254, Research Triangle Park, NC 27709, 919/549-4093. Selected papers are available for download at the world wide web site http://www.rtp.srs.fs.fed.us/econ/.

Conjoint Analysis of Nature Tourism Values in Bahia, Brazil

Thomas Holmes
Southern Research Station
U.S. Forest Service
Research Triangle Park, NC

Chris Zinkhan
The University of Georgia
Athens, GA

Keith Alger
Institute for Socio-Environmental Studies
Ilhéus, Bahia
Brazil

Evan Mercer
Southern Research Station
U.S. Forest Service
Research Triangle Park, NC

Respondent Involvement and Conjoint Analysis: Calibrating Nature Tourism Values in the Atlantic Coastal Forest of Brazil

Abstract - This paper uses conjoint analysis to estimate the value of nature tourism attributes in a threatened forest ecosystem in northeastern Brazil. Computerized interviews were conducted using a paired comparison design. An ordinal interpretation of the rating scale was used and marginal utilities were estimated using ordered probit. The empirical results showed that the degree of respondent involvement, as predicted by socio-economic and antecedent motivational and processing variables, influenced the location and slope of the estimated underlying utility function. Marginal values calibrated for consistency with economic theory were generally congruent with marginal values derived from imposing an indifference restriction whereas uncalibrated marginal values did not exhibit congruence. The respondent involvement metrics presented here were useful for calibrating natural resource value estimates to account for differences in how carefully potential consumers process complex stimuli typically used in conjoint analysis experiments.

Introduction

Conjoint analysis (CA) methods developed for conducting marketing research are becoming popular for conducting environmental valuation studies. A major attraction of CA to environmental economists is its capacity to elicit preference information for multi-dimensional bundles of environmental attributes. The CA method ostensibly provides richer information than the low dimension response surfaces elicited by other methods such as contingent valuation. Consequently, CA is considered to be informationally efficient (Mackenzie 1993).

The CA task presents a complex set of stimuli which respondents need to understand and process in a meaningful way. While the CA investigator typically relies upon assumed careful scrutiny by respondents of CA attribute information, it is not evident *a priori* whether or not this behavior is induced

globally or whether it is only induced for a "solid core" of respondents [1]. Lack of careful reasoning may influence stated preferences in a purely random fashion, creating statistical noise and large standard error estimates. Or the degree of care used in information processing may have systematic, measurable effects on stated preferences.

Antecedent respondent motivation may influence information processing behavior. Ajzen, Brown, and Rosenthal (ABR, 1996) identified respondent motivation as an antecedent factor conditioning contingent valuation willingness to pay responses in an experimental setting. ABR argue that issues with high personal relevance are likely to evoke careful processing of information via the "central processing mode". Conversely, issues with low personal relevance (and attendant low motivation) evoke the "peripheral processing mode" wherein judgements are subject to secondary factors such as superficial cues or reliance on simple cognitive heuristics.

Motivation has also been viewed as a necessary antecedent factor to processing brand information presented in advertising. MacInnis and Jaworski (1989) synthesize recent advertisement-attitude research and present an integrative framework. In particular, they argue that motivation (or the relevance of brand information to activated needs) is the mechanism that stimulates information processing .

The challenge confronting the designer of CA experiments is that the respondents are expected to undertake a very high level of information processing, namely role playing (as potential consumers of products), without any immediate return on the investment of effort (other than a warm "thank you"). The purpose of this study is to investigate the effect of respondent involvement on stated preferences elicited by the CA method. In particular, we introduce a model to test the hypothesis that respondent involvement interacts with rating scale measures of utility. Our results, which are based on surveys conducted in a developing country, indicate that respondents engage in varying levels of involvement with the survey instrument and that the degree of involvement influences economic value estimates.

In the next section, we present a traditional rating scale conjoint model that is modified to include degree of involvement as a determinant of respondent behavior. We then provide a description of our survey instrument and experimental setting. This is followed by results, conclusions, and implications for future research.

Rating Scale Conjoint and Respondent Involvement

The traditional rating scale conjoint model decomposes individual preferences into systematic and random components:

$$V^{ij}(Q^j) \quad v(Q^j) \quad \text{å}^{ij} \tag{1}$$

where $V^{ij}(Q^j)$ is the true but unobservable utility of commodity j to individual i, $v(Q^j)$ is the systematic component of utility and å^{ij} is a random error term with zero mean. Letting r represent individual *"i's"* rating of commodity j, Q^j represent a vector of attributes for commodity j (where q_n is the level of attribute n), and p is the price of commodity j, a linear preference function can be specified:

$$V^j \quad r^j \quad \text{á} \quad b_1 q_1^j \quad \ldots \quad b_k q_k^j \quad b_p p^j \quad \text{å}^j. \tag{2}$$

Equating the total differential of r to zero allows the marginal rate of substitution between attributes m and n to be computed as b_n/b_m. The marginal value of attribute m (Äp/Äm) is b_m/b_p where b_p is the marginal utility of money. Typically, commodity ratings are regressed on commodity attributes and price to estimate the b vector.

Mean intra-individual ratings μ_r have been viewed as centering points or anchors and have been considered as a source of statistical noise in the estimation process. To improve the "consistency" of ratings across respondents, Mackenzie (1993) included μ_r as an explanatory variable in his regression

equation. In contrast, Roe, Boyle and Teisl (1996) used a rating difference measure to "net out" the centering points.

Extending these earlier analyses, we hypothesize that the mean of the intra-individual distribution of preference ratings (μ_r) conveys information about the degree of respondent involvement. We present evidence that the distribution of intra-individual preferences generally shift from "centers" in the region of indifference to "centers" in the region of strong preference as the amount of time invested in the exercise increases. That is, with increasing involvement, people tend to have either very positive or very negative attitudes.

We anticipate that a major consequence of greater involvement in the CA task is that attribute information is more carefully scrutinized. Because time and mental energy are scarce resources, people with low motivation to provide well-considered responses (e.g., people who are not particularly interested in the increased provision of natural areas) may make mistakes in their responses at low internal cost. On the other hand, people who are highly motivated to provide well-considered responses face higher internal costs (e.g., in terms of regret) if they make mistakes in their responses (Freeman III 1986). We hypothesize that the degree of preference search as characterized by involvement shifts the utility function and influences marginal valuations as well:

$$V^j \quad r^j \quad \acute{a} \quad (b_1 \quad b_1\tilde{a})q_1 \quad ... \quad (b_k \quad b_k\tilde{a})q_k \quad (b_p \quad b_p\tilde{a})q_p \quad b_{k\ 1}\tilde{a} \quad \aa \qquad \textbf{(3)}$$

where b_m* is the "involvement" adjustment in parameter b_m, and $\tilde{a}$ is the level of individual involvement. If predicted involvement does not have a significant influence on marginal utility, or if mistakes in responses are random errors, this model collapses to the traditional conjoint rating scale model. If, however, the involvement adjustment parameters are statistically significant, parameter estimates are subject to omitted variable bias if they are not included in the regression equation.

For this experiment, we elicited conjoint responses using the Adaptive Conjoint Analysis (ACA) program provided by Sawtooth Software. Respondent characteristics were elicited using Sawtooth Software's Ci3 computerized interview software. The ACA procedure uses a pairwise comparison of commodity profiles, with one profile appearing on the left of the screen and one profile on the right. Respondents are asked to indicate which profile they prefer by supplying a numerical rating between 1 (strongly prefer left profile) and 9 (strongly prefer right profile). A response of 5 indicates indifference between the two profiles displayed. Respondents are requested to supply preference ratings for a series of paired commodity profiles. Because informational efficiency is expected to be greatest for paired comparisons with similar utility, ACA selects profile pairs based on predicted respondent utility. That is, ACA attempts to quickly move to points of respondent indifference.

The paired comparison approach may be viewed as eliciting utility differences between the left-hand side and right-hand side profiles (Magat, Viscusi, and Huber 1988). For our model, the utility difference between two profiles *j* and *h* equals

$$V^j \quad V^h \quad dV \quad \text{á} \quad (b_1 \quad b_1\tilde{\text{a}})(q_1^j \quad q_1^h) \quad \ldots \quad (b_k \quad b_k\tilde{\text{a}})(q_k^j \quad q_k^h) \quad (b_p \quad b_p\tilde{\text{a}})(q_p^j \quad q_p^h) \quad b_{k\ 1}\tilde{\text{a}} \quad e \qquad \textbf{(4)}$$

where $(q_m^j - q_m^h)$ is the difference in levels for attribute *m*. Equation (4) was estimated using an ordered probit algorithm. [2]

Respondent involvement in the CA task was proxied using two metrics. The first metric was the amount of time the respondent invested in the CA task. We hypothesize that time is a proxy for how carefully respondents process the complex CA stimuli and that greater investments of time result in more reliable responses. The second metric was based on an instrumental variable using the mean of the distribution of intra-individual ratings:

$$\mu_r \quad \sum_{k\ 1}^{m} r \quad 5\ /m \qquad \textbf{(5)}$$

where m is the number of attribute bundles rated. The computed value μ_r was regressed on a set of socio-economic and antecedent motivational and processing variables using OLS. Parameter estimates were used to predict values for the instrumental variable. Respondent involvement indices ã were computed by dividing individual predictions for μ_r by the maximum predicted value over all respondents. The involvement indices based on time and on the instrumental variable were then used as autonomous and interaction variables in the ratings equations as shown in equation (4).

Following the method of Magat, Viscusi and Huber (1988) we also estimated the average marginal rates of substitution by constraining analysis to pairs of profiles for which the respondent was indifferent (i.e. where rating = 5). The marginal rates of substitution are estimated by the parameter vector **ä** in the following regression:

$$\ddot{A}expenditure \quad \acute{O}_i \ddot{a}_i \ddot{A} q_i \quad e_{\ dV \quad 0} \qquad \textbf{(6)}$$

A comparison of the marginal rates of substitution estimated at points of indifference with marginal rates of substitution computed from estimated equation (4) indicates the relative congruence of the two methods.

Experimental Setting and Design

The Atlantic Coastal Forest of Brazil (Mata Atlântica) is one of the most diverse and threatened tropical forest ecosystems in the world. The region around the Una Biological Reserve in southern Bahia (northeastern Brazil) is under a particularly severe threat of deforestation due to the collapse in world cocoa prices that has forced many farmers to cut their forests to pay expenses. The forests in this region

contain very high levels of endemism and biological diversity. For example, these forests contain the only remaining native habitat of endangered primates such as the golden-headed lion tamarin and the yellow-breasted capuchin monkey. A recent forest inventory found a world record number of tree species in a single hectare in this region (Thomas and Carvalho 1993).

Nature tourism is an economic activity that may provide economic opportunities to private forest owners and help conserve forests in this region. Currently, most visitors to the Ilhéus region of southern Bahia come to visit the beaches and international visits to the coastal areas in this region of Brazil are increasing. The Inter-American Development Bank views tourism as an important economic development sector for this region and is investing significant resources to improve the tourist infrastructure. Forest conservation may play an important but poorly recognized role in enhancing the tourism value of this region by providing esthetically pleasing landscapes and opportunities for forest-based recreation. Further, forest conservation may help stabilize soils, protect water quality and conserve biological diversity.

To assist conservation planning efforts in this region, we developed a conjoint analysis instrument to provide information about forest protection values and potential forest attractions. Computerized intercept interviews were conducted at the beach, in local lodgings, and at local nature attractions. Of the 215 interviews completed, 200 respondents were Brazilian (interviews were conducted in Portuguese). The remainder of the interviews were conducted in English.

The interviews were conducted in two parts. First, as part of the Ci3 interview, people were asked to provide socio-economic-demographic information about themselves and their family and their itinerary for their current trip[3]. Then they were asked to participate in the conjoint (ACA) interview. This section was introduced by asking respondents to consider the kind of tourism features they would want for a visit to southern Bahia. The ACA interview proceeded by introducing attributes and attribute levels. Respondents were asked to eliminate any level that was unacceptable and to indicate the importance of

attribute levels. Based on this preliminary information, ACA proceeds to a pairwise comparison of profiles. Finally, respondents were asked to indicate the likelihood that they would purchase specific tourism packages composed of the various attribute levels. This concluded the interviews.

Empirical Results

Descriptive statistics for the variables used in the analysis are shown in Table 1. Respondents were relatively young (mean = 36.7 years), well-educated (75% had some college education), and had above average incomes (R$2272 per month)[4]. Most respondents were visiting the area primarily for beach recreation (42%), followed by nature tourism (36%), visiting friends (5%), cultural tourism (2%) and shopping (1%). Business and other reasons accounted for the remainder of visits.

Frequency distributions of paired comparison ratings for selected time categories are shown in Table 2. The most striking result in this table is that, as the amount of time invested in the conjoint task increases, the proportion of "indifferent" responses (rating = 0) decreases and the proportion of "strong preference" (rating = 4) responses increases. Apparently, as involvement increases (as measured by investment of time) intensity of preference increases as well.

Results of the OLS regressions of intra-individual mean ratings on a set of explanatory variables are shown in Table 3. The explanatory power of the regression is significant (adjusted R^2 equal to 0.298) and somewhat higher than Goodman's (1989) regressions on the determinants of mean housing ratings. As could be anticipated by the general results in Table 2, the amount of time invested in the conjoint task was very significant (at better than the 0.01 level) in explaining mean intra-individual ratings. Several motivational variables depicting primary reasons for the current trip were also significant in explaining ratings distributions and had the expected signs. For example, it was anticipated that people who were taking nature tourism trips would be more involved in the experiment than, say, respondents who were

primarily visiting the beach or on shopping trips. The level of income and education were also found to be statistically significant.

Ordered probit parameter estimates of marginal utility are shown in Table 4. For the standard rating scale model respondent utility increased with increased forest protection, higher quality lodging, and a complete bundle of nature tourism attributes. Respondent utility declined with higher daily expenditures, occasional traffic jams, and single activity nature attractions.

The calibration models demonstrated superior statistical fit relative to the standard model as evidenced by percent correct predictions, log-likelihood ratios and $\div^2$ statistics. In general, parameter estimates on the additive and interactive ã terms indicate that predicted degree of task involvement had dual effects on marginal utility - location and slope of utility parameters were influenced by involvement proxies. Further, we found that increasing respondent involvement moderated the estimates of imputed marginal values. This result is consistent with Whittington et al. (1992) who found that people who were given time to think about contingent valuation questions gave significantly lower bids than those who did not have that time.

The effect of respondent involvement on rating responses can be seen by examining the entrance fee parameter estimates. The parameter estimate on the *entrance_ fee* variable represents the marginal utility associated with an increase in the fee charged to access nature tourism sites. The standard model parameter estimate indicates a positive marginal utility (but the estimate is not significantly different than zero). However, the involvement interaction parameter estimates on *entrance_fee* indicate that: (1) people with lower than average levels of predicted involvement mistake price for quality (marginal utility is positive), and (2) as involvement in the CA exercise increases, marginal utility associated with increases in entrance fees becomes negative - as anticipated by economic theory.

Given that trip expenditures are a small proportion of respondent income, economic theory also predicts that the marginal utility of money is constant across expenditure categories. Consequently, the

marginal utility of money computed from the *daily_ expenditure* parameter estimate should be similar to the marginal utility of money computed from the *entrance_fee* parameter estimate and the marginal rate of substitution between these expenditure categories should be minus one. The data in Table 5 shows that this is not the case and that respondents viewed these expenditure categories differently. For the standard and calibration models, the average respondent mistakes price for quality and, therefore, the marginal rate of substitution has the wrong sign. However, the involvement interaction parameter on the calibration models permit calibration to the point where the marginal rate of substitution between expenditure categories equals minus one[5]. This procedure is used to compute calibrated values for nature tourism attributes that are consistent with economic theory.

The results in Table 5 show the marginal value estimates computed from the ordered probit parameter estimates. In general, respondents were willing to pay between $R0.77 and $R2.05 per adult per day to protect the remaining rain forests in this region. Aggregate estimates of the loss in economic value associated with loss in forest cover are large. For example, a 10% loss in forest cover in southern Bahia averaged over 100,000 annual visitors to the region would result in a loss in value of $R770,000 - $R2,050,000 per year to the region.

Nature attraction variables were embedded in the next higher level. The *nature_park1* variable was described as "a nature park located in a small forest where visitors can see many tall trees as well as birds and free-ranging golden headed lion tamarins". The *nature_park2* variable was described as *nature_park1* plus "a walkway constructed in the forest canopy" and the *nature_park3* variable was described as *nature_park2* plus a "botanical garden on a cocoa farm". We tested the hypothesis that respondents value nature park attributes in a manner consistent with economic theory - that is, more inclusive levels in the embedding structure reveal higher marginal utilities.

The value estimates reported in Table 5 showed that marginal rates of substitution (and value) generally increased with the level of inclusion in the embedding structure. This result is encouraging

regarding the potential reliability of conjoint analysis and suggests that people make economically rational responses when they have "full information" and the embedding structure of the problem is apparent. From a nature tourism development standpoint, these results also suggest that the greatest economic value is captured by developing nature attractions with multiple attributes.

Table 5 also shows the average marginal rates of substitution computed at points of respondent indifference. The regression of indifferent pairs (using equation (6) above) only uses information on profile pairs for which respondents were indifferent and not on all expressions of utility. It therefore represents a partial indicator of respondent preferences. However, two important conclusions emerge from the data in Table 5. First, the regression of indifferent pairs model shows that the marginal rate of substitution between daily expenditures and entrance fees was negative but more negative than minus one. This result (indicating that the loss in utility from increasing entrance fees is greater than the loss in utility from increasing daily expenditures) may reflect the fact that entrance fees for nature sites in Brazil are uncommon and that a lot of free substitute sites are available. Second, marginal values calibrated to a marginal rate of substitution of minus one between expenditure categories were congruent with the marginal values computed from the regression on indifferent pairs. In contrast, congruence was not apparent for the standard model.

Conclusions and Implications

The search for methods to calibrate responses to survey questions across heterogeneous groups is a relatively new effort in natural resource valuation. In this paper, we used information on intra-individual rating distributions and socio-economic, motivational and behavioral variables to estimate indices of respondent involvement in a conjoint analysis experiment. The indices were used to calibrate the value of nature tourism attributes in a developing country setting. In general, marginal imputed values were

sensitive to the calibration indices and calibrated values were congruent with values estimated at points of indifference.

Although respondent involvement probably influences value estimates derived using other stated preference formats, such as contingent valuation, the complex stimuli used in conjoint analysis to elicit multi-dimensional response surfaces may make this method particularly susceptible to involvement effects - particularly for the general public. It is not clear whether or not conducting this experiment in a less developed country exacerbated the involvement effect, although the use of computerized interviews did generate interest in the survey instrument. Further research should be undertaken to test the generalizability of our respondent involvement model in other experimental contexts.

This research brings to the fore the larger question "Whose preferences should count when conducting a valuation study?" At a minimum, this research re-iterates the point that to be useful, responses should reflect predictions from economic theory. Our finding that some respondents did not distinguish between price and quality (in terms of entrance fees) clearly violated the *ceteris paribus* condition necessary to an economic interpretation of conjoint analysis (although this mistake may not be uncommon in actual consumer decisions). Consumer choices may proceed by first evaluating the relative importance of the choice situation itself and the degree of effort the consumer is willing to invest. Potential consumers (such as respondents to conjoint analysis questions) who are willing to tolerate errors at low internal cost (in terms of regret) may provide information that biases economic value estimates. The ability to detect and correct such biases is an important area for consumer preference research.

Literature Cited

Ajzen, I., T. C. Brown, and L. H. Rosenthal. 1996. "Information Bias in Contingent Valuation: Effects of Personal Relevance, quality of Information, and Motivational Orientation". *Journal of Environmental Economics and Management* 30:43-57.

Freeman, A. M. III. "On Assessing the State of the Arts of the Contingent Valuation Method of Valuing Environmental Changes". In, *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method* (R. G. Cummings, D. S. Brookshire, and W. D. Schulze, eds.). Totowa, NJ: Rowman & Allanheld.

Goodman, A. C. 1989. "Identifying Willingness-to-pay for Heterogeneous Goods with Factorial Survey Methods". *Journal of Environmental Economics and Management* 16:58-79.

Greene, W. H. 1992. *LIMDEP: User's Manual and Reference Guide Version 6.0.* Bellport, NY.

MacInnis, D. J. And B. J. Jaworski. 1989. "Information Processing from Advertisements: Toward an Integrative Framework." *Journal of Marketing* 53:1-23.

Mackenzie, J. 1993. "A Comparison of Contingent Preference Models". *American Journal of Agricultural Economics* 75:593-503.

Magat, W. A., W. K. Viscusi, and J. Huber. 1988. "Paired Comparison and Contingent Valuation: Approaches to Morbidity Risk Valuation". *Journal of Environmental Economics and Management* 15:395-411.

Randall, A. 1986. "The Possibility of Satisfactory Benefit Estimation with Contingent Markets". In, *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method* (R. G. Cummings, D. S. Brookshire, and W. D. Schulze, eds.). Totowa, NJ: Rowman & Allanheld.

Roe, B., K. J. Boyle, and M. F. Teisl. 1996. "Deriving Estimates of Compensating Variation from Conjoint Data". Forthcoming in *Journal of Environmental Economics and Management*.

Thomas, W. and A. M. Carvalho. 1993. "Projeto Mata Atlântica Nordeste: Estudo Fitosociologico de Serra Grande, Uruçucu, Bahia, Brasil". *Paper presented at the XLIV Congresso Nacional de Botanica*, São Luis, Maranhão, Brasil.

Whittington, D., V. K. Smith, A. Okorafor, A. Okore, J. L. Liu, and A. McPhail. 1992. "Giving Respondents Time to Think in Contingent Valuation Studies: A Developing Country Application". *Journal of Environmental Economics and Management* 22:205-225.

Table 1. Variable descriptions

Variable name	Description	Value[1]
forest_protect	Amount of forest remaining	0%, 50%, 100%
entrance_fee	Fee per nature attraction (R$)[2]	5, 10, 20, 25
daily_expend	Food and lodging cost per adult (R$)	25, 50, 100, 150, 200
congest1	Rare traffic congestion	0, 1 dummy
congest2	Occasional traffic congestion	0, 1 dummy
congest3	Frequent traffic congestion	0, 1 dummy
lodge1	Camping facilities	0, 1 dummy
lodge2	Simple lodging (no air cond.)	0, 1 dummy
lodge3	Nice lodging (w/air cond.)	0, 1 dummy
lodge4	Luxury lodging	0, 1 dummy
lodge5	Exclusive resort	0, 1 dummy
nature_park0	Present situation	0, 1 dummy
nature_park1	View flora and fauna in forest	0, 1 dummy
nature_park2	Nature_park1 + canopy walk	0, 1 dummy
nature_park3	Nature_park2 + botanical garden	0, 1 dummy
mean	Mean rating	2.12
income	Monthly income (R$)	2272.1
educ	Dummy variable 1 = has some college, 0 otherwise	0.753
age	Respondent age, years	36.717
nature	Purpose of trip = nature tourism	0.356
beach	Purpose of trip = beach tourism	0.421
culture	Purpose of trip = cultural tourism	0.023
friends	Purpose of trip = visit friends	0.047
shopping	Purpose of trip = shopping	0.012
time	Time spent in ACA exercise in minutes	9.462

[1] Values for attributes are attribute levels. Other values are mean values.
[2] Monetary units are Brazilian Reis. At the time of the survey, 1 Reis = $1.12.

Table 2. Frequency distributions of paired comparison ratings as a function of time invested in the conjoint task.

Variable	Paired comparison rating scale 0	1	2	3	4
time < 5 minutes	151 (24.6%)	189 (30.8%)	100(16.3%)	57 (9.3%)	116 (18.9%)
5 min. *time* < 10 min.	15 (18.5%)	11 (13.6%)	24 (29.6%)	12 (14.8%)	19 (23.5%)
10 min. *time* < 15 min.	12 (3.7%)	85 (25.8%)	73 (22.2%)	68 (20.7%)	91 (27.7%)
15 min. *time* < 20 min.	5 (4.8%)	16 (15.2%)	30 (28.6%)	9 (8.6%)	45 (42.9%)
20 minutes *time*	13 (8.7%)	23 (15.4%)	24 (16.1%)	28 (18.8%)	61 (40.9%)

Table 3. OLS parameter estimates predicting intra-individual mean ratings as proxies for respondent involvement.

Variable	Linear model
constant	1.651***
	(0.108)
income	0.00004*
	(0.00002)
age	0.002
	(0.002)
education	-0.225***
	(0.056)
nature	0.257***
	(0.075)
beach	-0.143**
	(0.074)
culture	1.051***
	(0.182)
friends	-0.015
	(0.128)
shopping	-0.826***
	(0.208)
time	0.044***
	(0.003)
N	1082
Adj R^2	0.298

Note: *** denotes significance at the 0.01 level, ** denotes significance at the 0.05 level, and * denotes significance at the 0.10 level. Standard errors are in parentheses.

Table 4. Ordered probit estimates of marginal utility.

Variable	Standard model	Calibration model - Time	Calibration model - Instrumental variable
constant	0.906(0.080)***	-1.082(0.138)***	-1.316(0.380)*
Äforest_protect	0.008(0.001)***	0.134(0.002)***	0.022(0.007)***
Äforest_protect*ã		-0.0004(0.0002)***	-0.021(0.011)*
Äentrance_fee	0.009(0.007)	0.039(0.009)***	0.075(0.030)***
Äentrance_fee*ã		-0.002(0.0008)***	-0.126(0.054)**
Ädaily_expend	-0.004(0.001)***	-0.006(0.001)***	-0.010(0.005)**
Ädaily_expend*ã		0.0002(0.0001)**	0.010(0.008)
congest1	0.052(0.094)	0.359(0.132)***	0.491(0.453)**
congest1*ã		-0.018(0.011)	-0.633(0.816)
congest2	-0.204(0.090)**	-0.408(0.131)***	-0.412(0.433)
congest2*ã		0.010(0.10)	0.256(0.750)
congest3	0.530(0.229)**	-0.307(0.692)	0.514(1.003)
congest3*ã		0.028(0.041)	-0.642(1.333)
lodge1	0.082(0.123)	0.144(0.193)	0.661(0.609)
lodge1*ã		-013.259(0.016)	-1.076(1.080)
lodge2	-0.164(0.109)	0.078(0.146)	-0.145(0.504)
lodge2*ã		-0.022(0.010)**	0.065(0.865)
lodge3	0.245(0.110)**	0.644(0.133)***	0.823(0.430)**
lodge3*ã		-0.030(0.012)**	-0.977(0.763)
lodge4	0.018(0.132)	-0.053(0.233)	-0.680(0.698)
lodge4*ã		0.012(0.025)	1.129(1.216)
lodge5	0.532(0.228)**	0.243(0.969)	1.483(1.066)
lodge5*ã		-0.005(0.086)	-1.692(1.712)
nature_park0	0.438(0.344)	0.076(0.700)	1.453(1.169)
nature_park0*ã		-0.003(0.047)	-2.264(1.760)
nature_park1	-0.201(0.118)*	-0.934(0.238)***	-2.057(0.741)***
nature_park1*ã		0.048(0.017)***	2.798(1.210)**
nature_park2	0.131(0.093)	0.479(0.125)***	0.740(0.446)*
nature_park2*ã		-0.347(0.011)***	-1.041(0.798)
nature_park3	0.488(0.107)***	0.669(0.171)***	0.884(0.577)
nature_park3*ã		-0.030(0.015)**	-0.555(1.037)
ã (time)		0.027(0.009)***	
ã (instrumental var.)			4.092(0.676)***
µ (intra-individual)		0.986(0.047)***	
µ1		1.098(0.054)***	0.938(0.052)***
µ2		1.823(0.063)***	1.543(0.060)***
µ3		2.403(0.068)***	2.010(0.065)***
N	1082	1189	1082
% correct predictions	0.295	0.452	0.353
(1 - log-likelihood ratio)	0.026	0.172	0.083
÷2	88.657	305.355	284.427

Note: *** denotes significance at the 0.01 level, ** denotes significance at the 0.05 level and * denotes significance at the 0.10 level. Standard errors are in parentheses.

Table 5. Marginal value estimates for nature tourism attributes in Bahia, Brazil.

Variable Regression of	Conjoint Analysis			
	Standard model[1]	Calibrated - time model[2]	Calibrated - instrumental variable model	indifferent pairs - restricted sample[3]
forest_protect	2.05	2.33; 1.26	1.00; 0.77**	0.63
entrance_fee	2.29	4.88; -1.00*	0.30; -1.00*	-2.04
nature_park1	-51.54	-118.55; -46.44*	-45.83; -16.40**	-21.07
nature_park2	33.51	40.00; -0.09**	74.00; 3.60**	-0.96
nature_park3	125.08	93.95; 43.67**	87.52; 50.24*	33.65

Note: ** and * signify that the value is within 2 or 3 standard deviations, respectively, of the value computed from the regression of indifferent pairs.

[1] Computed from parameter estimates in Table 4 using mean values of independent variables.

[2] First number computed using mean values of independent variables and second number calibrated on the marginal utility of money as explained in the text.

[3] Parameter estimates from multiple regression equation shown in equation (6) in text.

1. Randall (1986) introduces the notion that the analyst focus on identifying the "solid core" of reliable observations for contingent valuation studies.

2. We used the ordered probit algorithm provided by Limdep software (Greene 1992).

3. Socio-economic data was not available for 20 respondents.

4. Monetary units are Brazilian Reis. At the time of the survey, 1 R$ = US$1.12.

5. For example, the marginal rate of substitution between expenditure categories equals minus one where time equals 13.8 minutes (for the time model) or where predicted intra-individual mean index equals 0.676 (for the instrumental variable model).